'The big picture': keynote address

LTG Douglas Buchholz, director of the command, control, communications and computers directorate, J-6, gave Signaleers the big picture in his keynote address at the 1997 Signal symposium.

"Let me take you into the world I live in a little bit. ... Hopefully some of the decisions made there will benefit you, as well they should," the former Chief of Signal said. "Since last year ... we've had something called the QDR (Quadrennial Defense Review). I won't talk about that other than the fact that it had an impact on us.

"Meanwhile, in the information world, we've got new standards. We've relooked (Defense Message System) real hard. We've made some decisions on some new satellites that follow on to (Defense Satellite Communications System). We've got a new joint tactical radio led by the Army coming out of the chute. There's been some pretty significant things done in the last year," Buchholz said.

But the future is on our doorstep, he said. "We're one year closer to tomorrow — 4,410 days or 12 short years. Between now and 2010, we'll have eight to 12 major computer changes and a bunch of different soldiers growing up," Buchholz said.

Information demands have risen exponentially in recent years and will continue to do so. As an illustration, he noted big leaps from the past in how warfighters use information. In World War I, warfighters had tanks and machine guns, then in World War II used radar and bombers. By the time of the Cold War, warfighters had spy planes and missiles, then in Vietnam employed satellites, sensors and helicopters.

The Gulf War, however, was something new. By the early 1990s, the U.S. military had "precision strike and the logistics superbowl," Buchholz said. "The Gulf War gave us the first glimpses of what information warfare could do. What our maneuver commanders found out was that information could make a massive difference, both between the (tactical-operations centers) and within the weapons systems themselves.

"In 2010, that's going to expand about 10 times. The bottom line ... is the Army term is information dominance, the joint term is information superiority, and we've got to have that sooner and not later," he said.

The road to 2010

How is information technology changing today? Demand is outpacing capability already, and will 50-1 "if we don't do something quick."

In 1997-1998 we still need to get information to the lowest levels and make equipment user-owned and -operated. "We haven't gotten it right yet," he said.

The Army also needs to determine how to "fight" information technology. "I'm trying to give folks a wakeup call on this," Buchholz said. "There's a lot of hooah on (information technology) but not a whole bunch of do-ah."

By 2001, Buchholz sees an increase needed in horizontal pipes to counter a big ground-domain problem: four times the mobile-subscriber equipment levels and 50 times the push-to-talk levels the military has now.

By 2001, the Signal Corps will also have the challenge of the "robosoldier" and "robostaff." "You've seen the robosoldier," he said. "He's your infantryman with (today's experimental equipment).

You have staffs that need information extremely fast, need to crunch information extremely fast, and get decisions to the commanders."

Functional users will also need to "get with it" or the Defense Department will have to "grow the Signal Corps." According to Buchholz, the Signal Corps' growth — including other services' comparable jobs and roles — will happen anyway to a limited degree.

By 2001 ways to get rapid technology will have to improve. The acquisition system is changing for the better, Buchholz noted, but the "decision system" and "money system" also need to change. "The decision system is still layered," he said. "We need to narrow it down and empower people, and we've got to have to money there that can be used instantly and not (programmed) for five years out. We'll continue to be 'OBEd' if we keep doing that."

Buchholz also envisions the necessity of creating "info-captains" now to be able to cope with all the changes by 2001. "The folks that use this stuff have got to wake up and understand how to do it," he said.

By 2005, the military will need to "deappetize demands," but earlier than 2005 will be better. There must be economic coupling to information demand. The Joint Requirements Oversight Council will demand of anyone who sends or receives information how much information the agency will send and why. Buchholz said JROC plans to tax people who have demands that are more than the system can reasonably provide. The "taxes" will go into the "C4 pot."

He believes this approach will drive down demand, but if an agency has that great a demand, it can help provide the infrastructure.

"This has lots of ears listening," Buchholz said. "I've got to hang some meat on it now."

Other information-technology changes required by 2005 include a five-times increase in vertical pipes, or satellite communications, plus a lessening of Signal Corps' hands-on work and an increase in its management and advice role. "We've got to make the equipment more user-friendly," Buchholz said. "We can't continue to fix it and operate it for them."

Besides this change in attitude, the Signal Corps also needs to emphasize "telemetry" and change its training. "Telemetry simply means feedback to the user," he said. "He has to understand how much (information) he is using and how much he has, because information and the ability to move it is always going to be scarce.

"We need a total change in how we do (information technology) training," Buchholz said. "Just-in-time training is going to be the wave of the future."

For 2010, he said tongue-in-cheek, the joint staff has "large dreams." "It'll probably never happen, but I set it as a goal, because if I can create a system whereby you're accountable for your demand, and the Signal Corps has the capability it needs, there is some point where demand (for information) should more or less equal supply," Buchholz said.

By 2010, information will be a weapon. "If you have information superiority, you lock the enemy out," he said. "Speed of command is the process ... destruction is the product. We need to 'float like a butterfly and sting like a bee,' and we have 4,410 days to create these conditions."

Buchholz listed some of his expectations for the future:
- Command-and-control on the move;
- Increased video demand;
- Operational tempo greater times three;
- Situation awareness anywhere;
- Information "what ifs";
- Small TOCS, dispersed and mobile, probably wireless;
- Fluid networks;
- Training in the tank or tent; and
- Reasonable cost, less sustainment.

Network-centric warfare

Networks will be the big picture, our future, Buchholz said. Defense will become "network-centric," a concept which comes from industry and is led by industry. Network-centric features ecosystem relationships and a "whole" that's greater than the sum of its parts.

Warfare will become network-centric. "It's all about interconnections," he said. There are three parts to network-centric warfare: sensor grids, engagement grids and information grid.

Simplified, sensor grids of space, air, sea and ground-based sensors generate battlespace awareness in three pieces: "us," "them" and environment. The sensor grid synchronizes battlespace awareness with military operations.

Engagement grids of air, sea and ground-based "shooters" exploit battlespace awareness and make platforms a part of the network.

The information grid "is the Signal Corps," Buchholz said. We need to try and strengthen the information grid over our battlespace, which is the world. The 2010 information grid must be fluid, flexible robust, redundant, and real-time; have integrity and security; have access and capacity; be joint- and coalition-capable; and have an ubiquitous backplane.

Figure 1. The Army needs to strengthen its information grid.

Network-centric warfare will feature decentralized empowerment; alternative command structures and procedures; self-adapting and learning organizations; self-synchronizing forces; battlespace awareness synchronized with combat power; and increased information velocity.

Where are we in this? In 1997 we're a digital baby, according to Buchholz; by 2010 we need to become a digital adult via basically two actions: the user must mature and the Signal Corps must lead.

Users must mature by immersing themselves daily in information technology; creating into-captains; becoming efficient or paying the price; and making wise budget trade-off decisions.
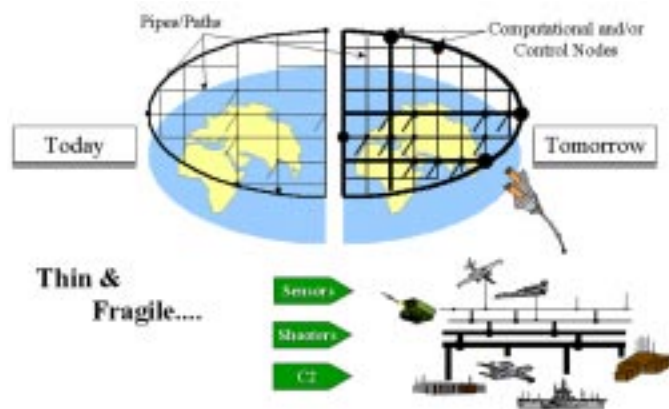
The Army's Signal Corps leads, Buchholz said. "Folks look to you for how you've done it," he noted on Signal Corps successes with software and network management.

With droll humor, he said the Signal Corps would also lead in modeling the future; modifying the laws of physics; leading the joint community; leveraging industry; buying fast; and training smart. "If you do it all," he said, "the Signal Corps can have something it's never had before (gets sleep)."

Buchholz outlined ways in which industry could help the Signal Corps: pipes ("need them bigger and to go more places"); power ("more efficient"); antennas ("ubiquitous"); training ("anywhere, anytime"); networks ("our networks must work together"); waveforms ("we have a dire need for waveforms"); compaction ("getting more in the bandwidth

you have"); and management ("we need an integrated-systems control at the joint level also").

A big concern is frequency sell-offs. Buchholz asked his "industry friends" listening to stop bidding for the government to sell off military frequencies. He said he'd just come from a hard fight in Geneva, Switzerland, trying to block commercial bids for Global Positioning System frequencies. "U.S. industry is part of this," he warned, "but we can't sell off military frequencies and win the wars we need to win."

Symposium's military speakers look at Army changes

Although the 1997 symposium's theme was "partnership with industry," a subtheme could have been change: change in acquisition, change in networks, change in the Signal Corps. Speakers looked down the road to the year 2010 and at what it would take for the Signal Corps to get there.

On the symposium's first day, attendees were treated to the collective expertise of LTG Paul Kern, LTG David Kelley, LTG William Campbell, MG Larry Lehowicz, MG Gerard Brohm and BG Steven Boutelle. Highlights from their remarks follow.

Army acquisition's future

Kern, the Army Acquisition Corps' director, formerly commanded 4th Infantry Division, the Army's experimental force in Force XXI. Kern therefore has first-hand experience in the changes Task Force XXI is bringing to the Army. Unfortunately some of that change is in the area of refining budgets; the Army's research, development and acquisition budget in fiscal year 1998 is the lowest it has been since 1960.

More change is happening in the Army's approach to partnering. According to Kern, partnering will help sustain today's force at reduced cost; modernize the current force structure; field the first digital division by 2000; and conduct studies and experiments for Army After Next while we continue to reform the acquisition process.

The Army has set up the year 2025 as the target for AAN, but Kern said a recent defense panel concluded "that's too slow." The panel is recommending AAN be fielded to XVIII Airborne Corps when Army XXI (target year: 2010) is fielded to III Corps.

The Army is using spiral development with science and technology, research and development, production and sustainment to develop AAN from today's Army. Spiral development is a new way of doing business, a partnership with no internal barriers between Army organizations and industry. Kern said spiral development works better; it provides interfaces between the people using certain equipment and the technology behind that equipment.

At Fort Hood, Texas, where the Force XXI experimentation took place, Kern said the true benefit of the combined technical-support facility and advanced warfighting experiments was everyone's working together. More than 7,000 soldiers trained for Task Force XXI in 22 separate courses in CTSF and on platforms in Fort Hood's partnering effort. Kern said the Army needs to do spiral development and partnering everywhere, not just at Fort Hood.

Everyone's challenge is the "death spiral" in funding: since RDA dollars are decreasing and the total-obligation authority isn't going to
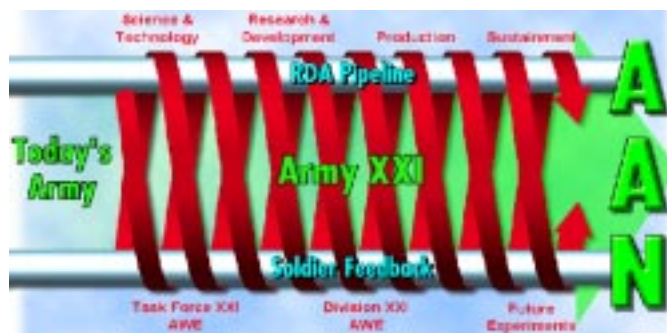

Figure 2. The acquisition mission is to use spiral development to develop Army After Next from today's Army.

increase, the Army must extend the service life of its equipment. Also of concern are increasing operations and supplies costs, especially when old equipment's service life becomes longer; Kern said Army organizations must work together to reduce ownership costs. Kern said he worries about the Signal Corps on the battlefield: about its footprint, its support costs and its survivability.

He said he's also concerned about about how fast the Signal Corps can get information technology to warfighters. "We can't afford to have communications-electronic

equipment that takes 20 years to field to the Army," he said.

Kern wants to reduce concept-to-fielding cycle times by "moving electrons" through virtual acquisition, which he defined as "the Army's visionary concept for acquiring supplies, equipment and services necessary to support Force XXI. The goal is to harness current technology to create an electronic infrastructure requiring no paper documentation." Paperless acquisition, tied with spiral development and improved production systems, will benefit equipment production in reducing cycle time; keeping the Army current with technology; providing continuous user, developer and contractor involvement; and reducing costs. The Army also established a "virtual contracting" website for acquisition that's a user-friendly push-button setup.

Technology demonstrations aid the acquisition process, according to Kern, by evaluating technology in an informal process that costs relatively little. Demonstrations also evaluate military value and utility before the Army commits to acquisition; help the Army develop operations concepts and doctrine early; and provide useful equipment proto-types quickly. One acquisition program Kern talked about provides flexible funding for industry to participate/demonstrate/simulate in AWEs and battle-lab warfighting experiments; solicits proposals from industry; helps battle labs evaluate new concepts; and enables research, development and evaluation centers to provide expedited contract support.

The Army's acquisition vision is to establish "a dynamic organization which provides warfighters affordable world-class weapon systems and services years before any adversary can acquire comparable technological capability. Systems are continuously modernized and the cost of ownership drastically reduced each year. Quality people, teamwork and caring leadership are the heart of the Army acquisition organization."

Kern summarized his remarks by saying industry and the Army are partners in readiness. AWEs, which demonstrate new processes and reduce cycle times, are successful due to everyone's "teaming" efforts.

Force XXI has convinced the defense secretary and Congress the Army has a vision for the future. "Now is the time to build on success and gain momentum," Kern said.

Joint communications

Kelley, Defense Information Systems Agency's director, gave an overview of joint communications. He said DISA is adopting a network-centric approach to make Joint Vision 2010 a reality. "We must have information superiority: the capability to collect, process and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same," Kelley said. "Right now horizontal integration is the biggest issue we've got."

Kelley outlined DISA's "pillar" programs: the global command-and-control and global combat-support systems, Defense Message System and Defense Information System Network.

GCCS offers a single system for peacetime and follow-on operations, deliberate planning, plus crisis planning and execution. GCCS today has the common operational picture, secret e-mail, Netscape Secret worldwide web, Netscape newsgroups, ATO read/display capability and graphics-based interface to more than 30 applications.

GCSS is an implementing initiative for interfacing and integrating corporate-wide service- and agency-sponsored combat-support systems. GCSS provides integration across the Defense Department's functional areas and from the

Figure 3. Joint Vision 2010 outlines the way America's Army can achieve information superiority.

sustaining base to the combat area.

According to Kelley, the goal is for GCCS and GCSS together to provide an integrated command, control, communications, computers and intelligence and combat-support infrastructure.

Quickly outlining the DMS program's status, Kelley said the military has completed its flexible architecture design. DMS Version 1.1 is now in formal testing. More than 200,000 user agents are planned for FY98.

For DISN, the military is integrating its space and terrestrial components. "Why haven't we done more on satellites? Because most of it's vaporware," he said. "We're letting that sort out a little bit. Iridium has more than half its constellation up, so we're moving out on that."

Everyone must help protect the defense information infrastructure, but some things DISA specifically is doing to help protect the network are:

● Enterprise-wide antivirus software has been available since Sept. 1, 1997. For more information, contact DISA's "assist" office at http://www.assist.mil on the worldwide web; commercial telephone (703) 607-4700 or DSN 327-4700; or e-mail assist@assist.mil.

● Netscape Enterprise license was effective Oct. 1, 1997, for the public key infrastructure. For more information, contact DII Enterprise licensing at http://www.menk.com/dod_license/license_faq.html; (703) 681-2088 or DSN 761-2088; e-mail licenses@ncr.disa.mil.
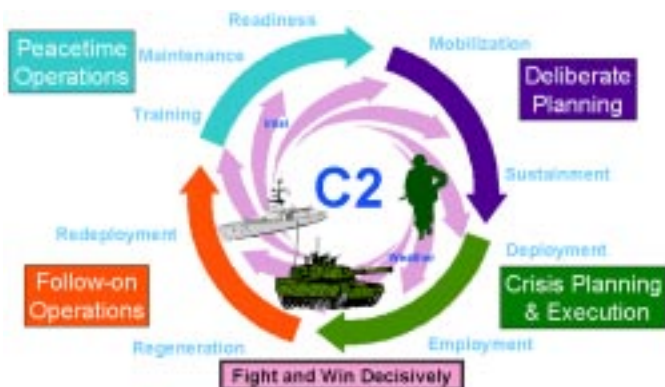
Figure 4. The global command-and-control system, one of Defense Information Systems Agency's pillar programs, offers a single system for peacetime and follow-on operations, deliberate planning, and crisis planning and execution.

Figure 5. Another of DISA's pillar programs, Defense Information System Network, provides seamless integration of space and terrestrial assets, the key to information superiority.

• Provides systems-administrator training.

FY98 is the "year of the product," Kelley said. DISA has produced or is producing GCCS Version 3.0 and GCCS' terrestrial version; will have DMS capability for more than 200,000 users, 38,000 of them Army; began the continental United States' DISN network migration and will see $84 million in annual savings beginning in FY98; and is working on GCSS integration.

Kelley shared the podium with Pete Paulson, DISA's networks-division chief, who gave symposium attendees more information on DISN-CONUS. Paulson said DISA was working toward totally integrating DISN worldwide, the biggest financial part being DISN-CONUS. DISA is embedding existing legacy

networks into DISN because the legacy networks don't conform to joint requirements.

DISA's original plan was to transition the DISN network in mid-January, but an industry-wide shortage of sonet – DISN-CONUS' backbone – postponed the completion date to July 30. The DISN-CONUS network migration is the single largest telecommunications transition in history – there are more than 10,000 switches to cut over. Installations and their liaisons must make DISN a priority to get these cutovers done, as every day past July 30 costs $400,000 a day. Since DISA gets its money from its "customer" agencies, it costs

installations that money.

Kelley also provided a demonstration on GCSS, done by Air Force LTC Steve Hoffman of U.S. Transportation Command to give a GCSS user's perspective. GCSS – likely to be one of DISN's biggest users – will provide the user what he or she is looking for: a single picture of the battlespace for decision-making. The global transportation part of GCSS is new and growing; it went from from 8,000 users to 25,000 worldwide in just a couple of months. Hoffman said there's more expansion in the picture for GCSS.

To round out the presentation, Kelley said communications tools are important, but combat-support tools such as GCSS are as well.

Enterprise XXI

Campbell, director of information systems for command, control, communications and computers and the Army's chief information officer, explained Enterprise XXI as a "world-class network for our world-class soldiers."

DISC4's vision for the year 2010 centers around network-centric warfare enabled by the Warfighter Information Network. Battlefield digitization will be a reality, he said, with "ubiquitous" computers. The Army will maintain information superiority; execute Army Vision 2010 and Joint Vision 2010 through
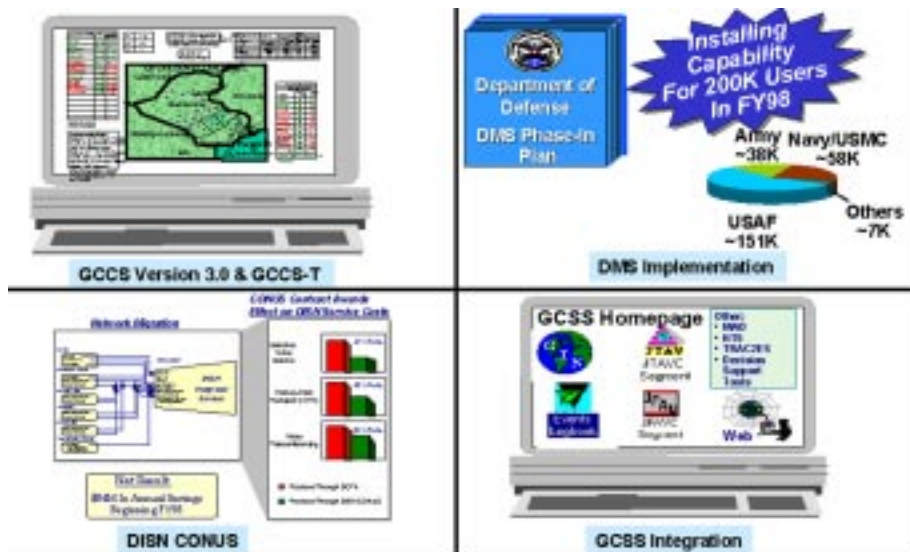

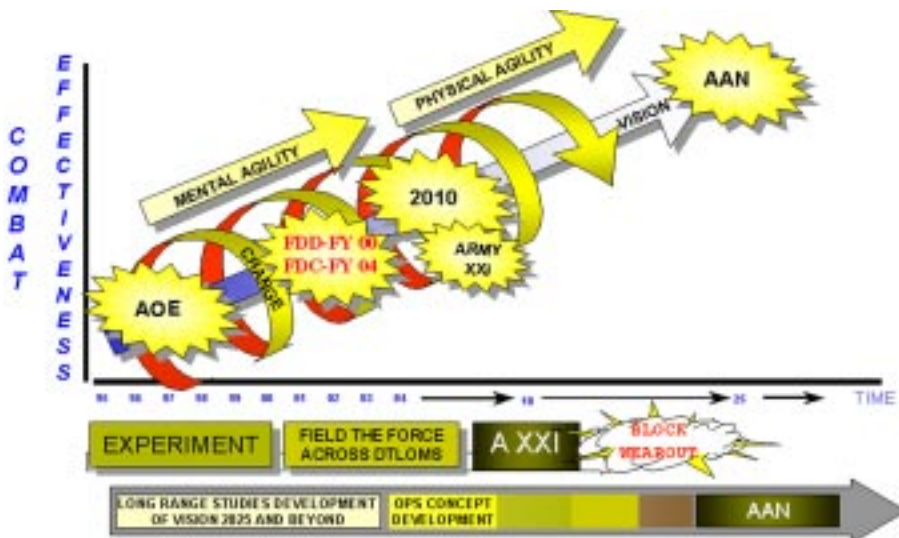**Figure 6. Fiscal year 1998 is the 'year of the product' for DISA.**

Figure 7. The Army's path to full-spectrum dominance.

C4/IT systems; re-engineer its institutional self with IT; continuously leverage commercial technology; and implement its C4/IT Enterprise strategy.

The Enterprise strategy's elements are:

- Focus on the warfighter;
- Ensure joint interoperability;
- Capitalize on space-based assets;
- Digitize the battlefield;
- Modernize power-projection platforms;
- Optimize the IT environment;
- Implement multilevel security;
- Ensure spectrum supremacy;
- Acquire integrated systems using commercial technology; and
- Exploit modeling and simulation.

"Change is here, change will be more and more rapid, and if we're not postured with our architecture to take advantage of developments in the commercial world, then we're going to get way behind the power cycle," Campbell said.

Echoing Kern's research-and-development discussion, Campbell said the Army will have more investment money for its information systems in the near-term, but by mid-term, funding will be reduced and the Army must modernize its information systems.

As LTG Douglas Buchholz did in his keynote address, Campbell outlined the capabilities and components of 2010's C4/IT infrastructure, including the three grids of network-centric warfare. Campbell described the information grid as providing the computing and communications "backplane." He said both sensors' and shooters' applications and peripherals will plug into the information grid's weapons systems.

Campbell envisions the Army using more and more commercial-off-the-shelf products. "My personal opinion is that we will ensure obsolence of our equipment and systems if we continue to buy $20,000 pieces of gear," he said. "Over the next five to 10 years, the Army more and more will leverage what comes out of the commercial world."

Key will be satellite communications. The Army's SATCOM transition to Force XXI involves the secure, mobile, antijam, reliable, tactical terminal and single-channel advanced manportable terminal in the extremely-high-frequency arena; AN/TSC-85B/93B and super-high-frequency triband advanced range-extension terminal in the SHF arena; Global Broadcast Service Phase II and III and GBS' tactical-injection point in Ka-band; and Spitfire in ultra-high frequency. Three gap-filler satellites were approved and will be launched in the FY04 to FY06 timeframe, Campbell said. These satellites won't provide enough

capacity; the military will use commercial SATCOM.

Changes in the way the Signal Corps and the Army do business are enroute, Campbell said. Personal-communications services and wireless capability to enhance situation awareness are cheaper and more capable than anything we have today, so the Army will begin to use PCS more. Unmanned aerial vehicles and satellites will provide PCS support. Wireless command posts will enhance mobility. Each tactical-operations center switch will have local PCS and wireless local-area network capability. Cell sites will provide terrestrial access. Warfighter multiaccess will be available from ground, aerial and satellite platforms. Systems must support continuous planning.

Army XXI is the military's effort to digitize the battlefield, but Campbell said most of Army would be digitized "long before 2010" and would continuously upgrade like "the way we upgrade software in offices now." By June 1998, Defense Department publications will be available only via the Internet or on CD-ROM.

According to Campbell, if the corps' and division's rear boundary is the sustaining base — and it is, according to Training and Doctrine Command guidance — and we're digitizing the battlefield, we must digitize the sustaining base. Key Army installations, reserve centers and National Guard armories are our power-projection platforms. In modernizing the total Army, Campbell said, we'll rely on the Reserve Component more and more, and it must "be part of our solution."

Testing for learning

Lehowicz, Operational Test and Evaluation Command's commander, discussed ways in which OPTEC and testing in general are changing. Recently the Army began a new way of doing business: testing, evaluating and experimenting for learning. Lehowicz credited the Signal Corps' impact on the Army and on other services for
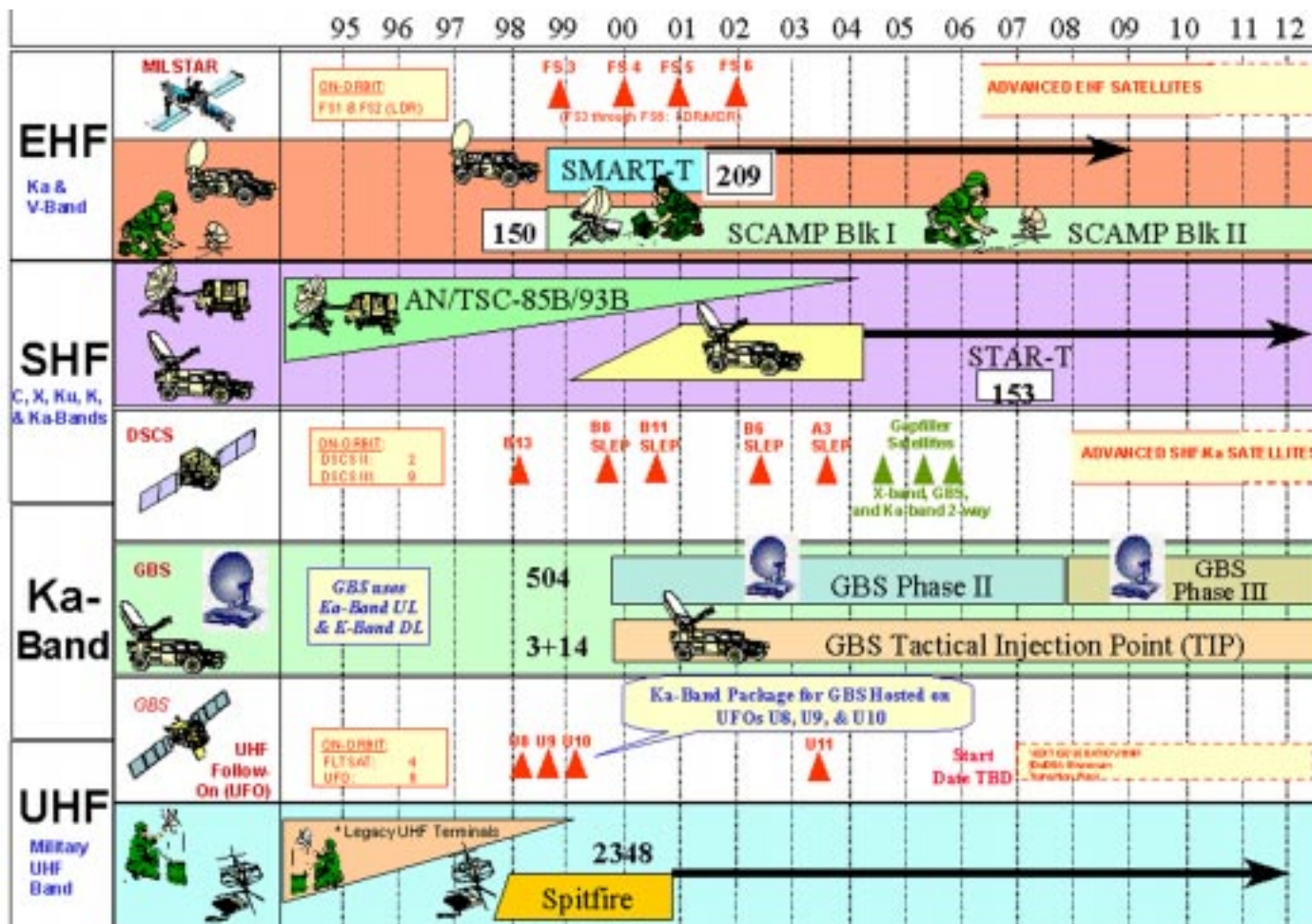
Figure 8. The Army's satellite-communications transition to Force XXI, as outlined by LTG William Campbell.

driving this change.

"Experiments are really the way to go for our Army," he said. "Our Army embarked on this new experimental approach a few years ago. None of us were really sure which way it was going to go, but it has evolved in a very, very helpful way. In my view, even traditional programs can be more experimental in nature if we change the way we think about testing and evaluation."

The benefits of testing for learning are:
- Continuous insight, continuous improvement;
- Quality built into the system from the very beginning;
- Early warning, early resolution;
- Program stability; and
- Program success.

"In the world of commercial testing, businesses create failures to learn from failures," Lehowicz said. On the other hand, in DoD, tests were considered as final exams, and people still consider testing as a "bad news operation." However, OPTEC, TRADOC and the project managers are testing for learning – featuring failure-mode analyses, early system trade-offs, early understanding and product improvement.

As of Oct. 1, 1996, OPTEC performs all technical and operational testing, Lehowicz said, so there's continuity on how testing is done. OPTEC's "new customers" are commanders and trainers, the science and technology base, battle labs (for AWEs), project managers (for operational field assessments) and industrial contractors. Lehowicz said he's convinced developmental testing will be done more and more in contractors' plants, and there will be more partnering between indus-

try and OPTEC.

An example of how the process is changing was the tactical Internet test for Task Force XXI. Situation-awareness visibility improved from initial testing to the Task Force XXI advanced warfighting experiment at the National Training Center, Fort Irwin, Calif. Lehowicz said the tactical Internet went from a very immature system to a highly successful one in a spiral-development process that took 11 months. The process usually takes five or more years, he said.

The design of the future Force XXI battle-command system for brigade and below tactical Internet will be markedly different from NTC's Applique/TI, according to Lehowicz. The significant changes planned require more testing and experimentation before the fielding decision; tests are scheduled through

2000.

The Army and industry should work together on rapid acquisition so U.S. soldiers can be the best-equipped in the world, Lehowicz said.

Joint Vision 2010

Communications-Electronics Command's commander outlined CECOM's role in Joint Vision 2010. CECOM provides C4I, electronic-warfare, sensors and information-management products and services that integrate the sustaining base to the battlefield, Brohm said. CECOM has the largest software engineering center in DoD, but that will change because of the Quadrennial Defense Review.

QDR will take CECOM down 73 percent in military spaces (621) and 20 percent in civilian spaces, according to Brohm.

CECOM's circumstance mirrors the Army it serves. Deployments are going up 170 percent, but buying power is going down 40 percent. The Army is losing 36 percent of its active duty and 42 percent of its civilians.

The United States is in the "knowledge age." As evidence of this, the 10 richest Americans are in software, media, investment and retail. Microsoft and Intel are bigger than GM, Ford, Boeing, Kodak, Sears, J.P. Morgan, Caterpillar and Kellogg put together, Brohm said.

The Signal Corps' job and its challenge are refining data to become information to become knowledge to become understanding. According to Brohm, total integration is the key to this.

Besides information's impact on American society, it has a huge impact on the battlefield. As an

example, Brohm illustrated information's impact on the task-force battlespace at NTC. In 1984 NTC exercises, the information battlespace was 40 square kilometers. By 1988 that had doubled to 80 square kilometers, reaching 160 square kilometers in 1992. In March 1997, however, at Task Force XXI's AWE at NTC, information's impact on the battlespace was 1,000 square kilometers.

This has created a change in the warfighter's perspective on the Signal Corps. The Signal Corps used to be considered the "tail" in "tooth to tail," where "tail" was anything that didn't shoot. Now the Signal Corps is the muscle in "tooth to muscle."

Joint Vision 2010 seeks information superiority, which involves precision engagement, focused logistics, dominant maneuver and
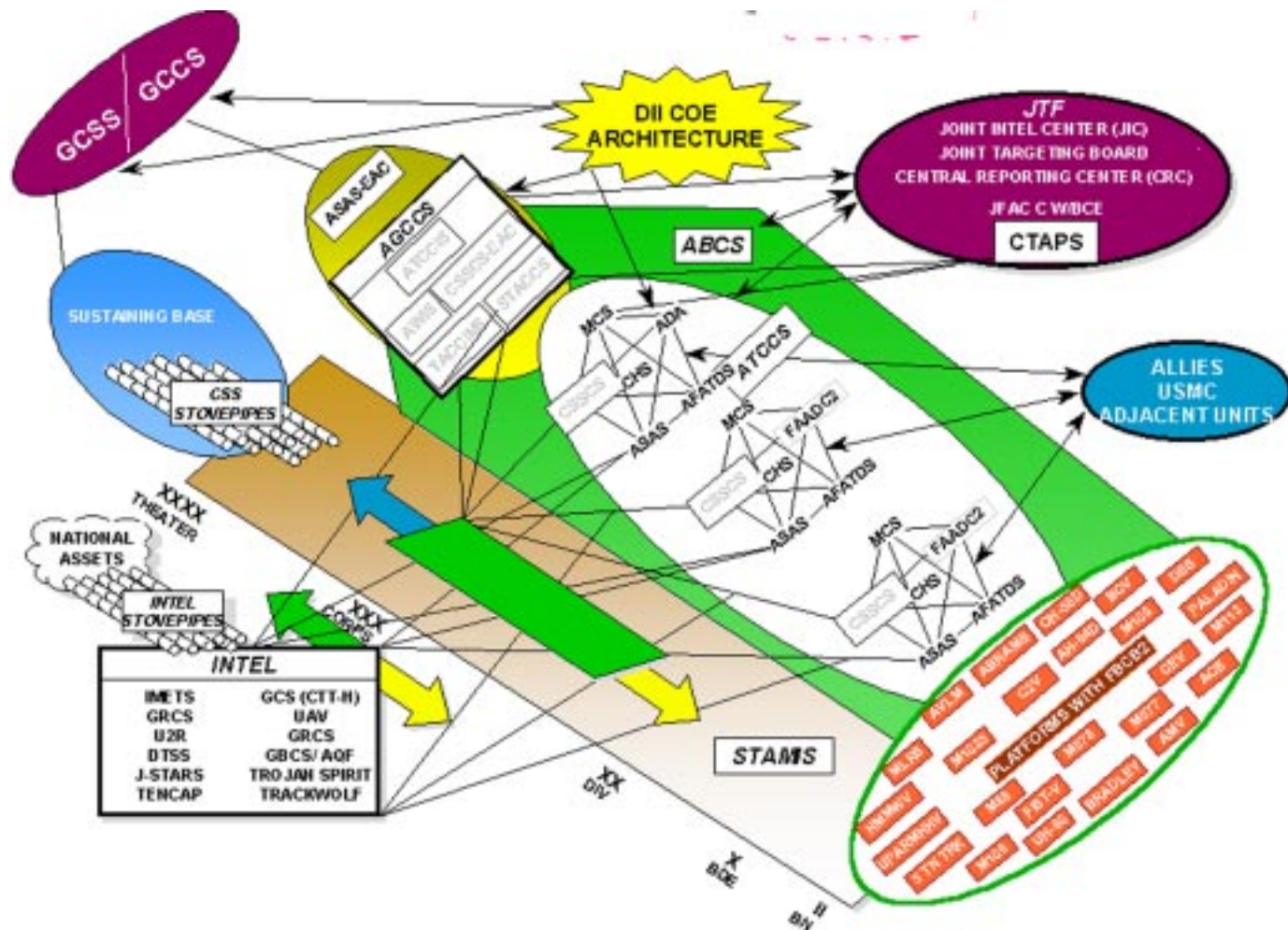

Figure 9. The Army's command, control, communications, computers and intelligence architecture.
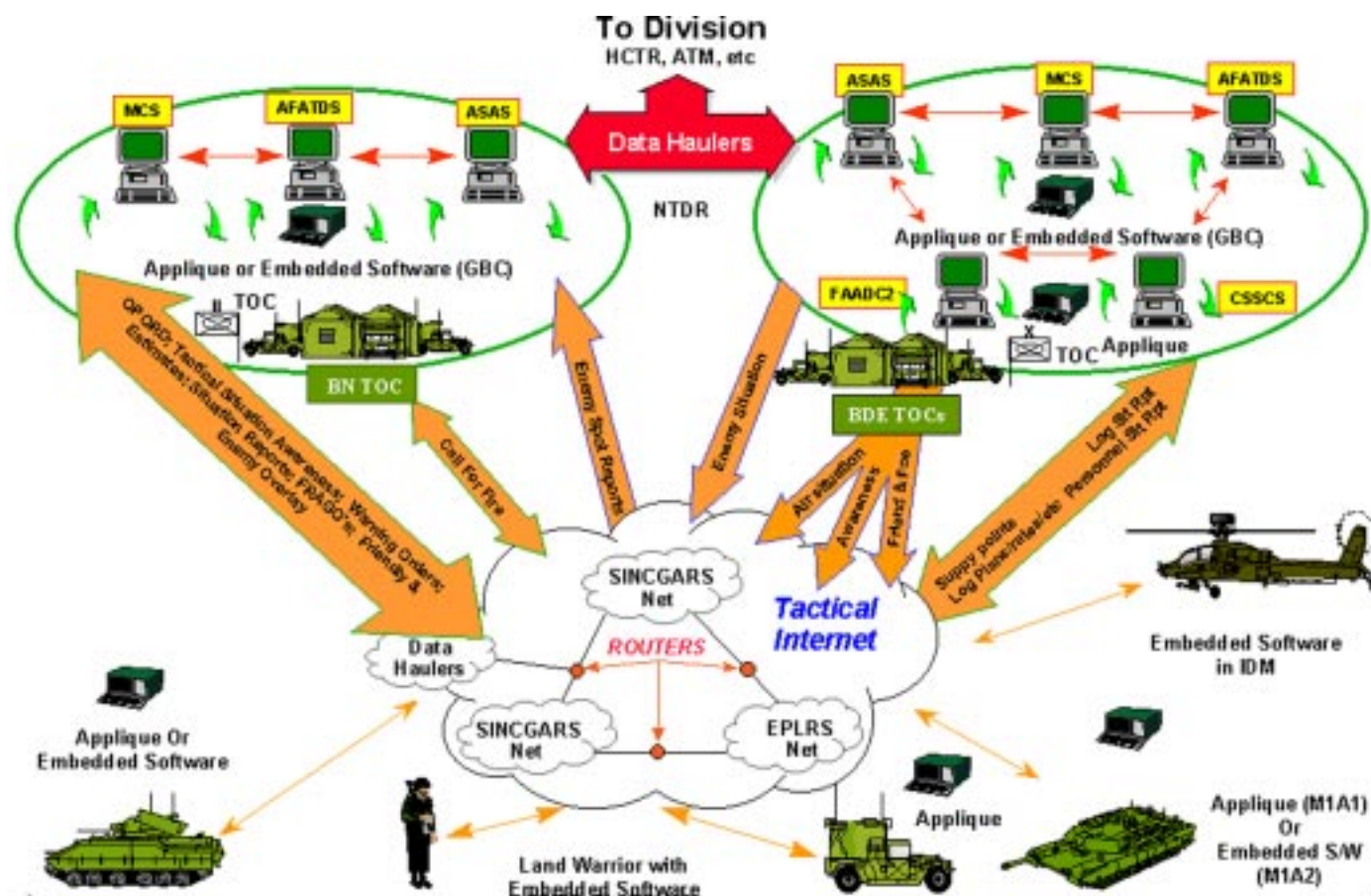
Figure 10. The Force XXI architecture will be more robust, flexible and automatic.

full-dimensional protection. The Signal Corps' impact on these four prongs is massive: on dominant-maneuver enablers, 75 percent; dominant-maneuver technologies, 100 percent; precision-engagement enablers, 83 percent; precision-engagement technologies, 100 percent; full-dimensional-protection enablers, 100 percent; full-dimensional-protection technologies, 100 percent; focused-logistics enablers, 100 percent; and focused-logistics technologies, also 100 percent. CECOM itself "brings to the fight" software, technology, logistics and acquisition experience.

Quoting Tom Peters, the "management guru," Brohm said survival in the knowledge age involves uniqueness: "It's no longer sufficient to be the best at what you do; now you must be the only one doing what you do!" CECOM's unique contribution is integration across business areas, platforms/weapons systems and echelons

(installation to battlefield).

CECOM has government partners in TRADOC schools and program executive officers/project-managers. Government partners, however, aren't enough; according to Brohm, CECOM must also have industry partners for totally integrated solutions in technology and information sharing.

FBCB2

Task Force XXI, especially FBCB2, was food for discussion to the PEO for command, control and communications systems as well. According to Boutelle, the Army was successful in Task Force XXI. "Success was totally contingent upon changing the way we're doing our business – with OPTEC, with spiral development – but the real hero was FBCB2," he said.

Boutelle defined FBCB2 as a battle-command information system that:

● Provides on-the-move, real-

time and near-real-time battle-command information;

● Enables situation awareness down to the platform and soldier across all battlefield functional areas;

● Is a key component of the Army's battle-command system; and

● Provides tactical combat, combat-support and combat-service support for leaders and soldiers.

FBCB2 answers three questions for soldiers: Where am I? Where are my buddies? Where is the enemy? FBCB2 consists of C2 software for air and ground platforms; tactical computers (hardware) for ground platforms/soldiers; and tactical Internet use (routers, enhanced position-location reporting system and single-channel ground and airborne radio system).

The Army's success depends on changing the C4I architecture. According to Boutelle, there are now three separate intranets and networks in existing communications, with little interaction: mobile-
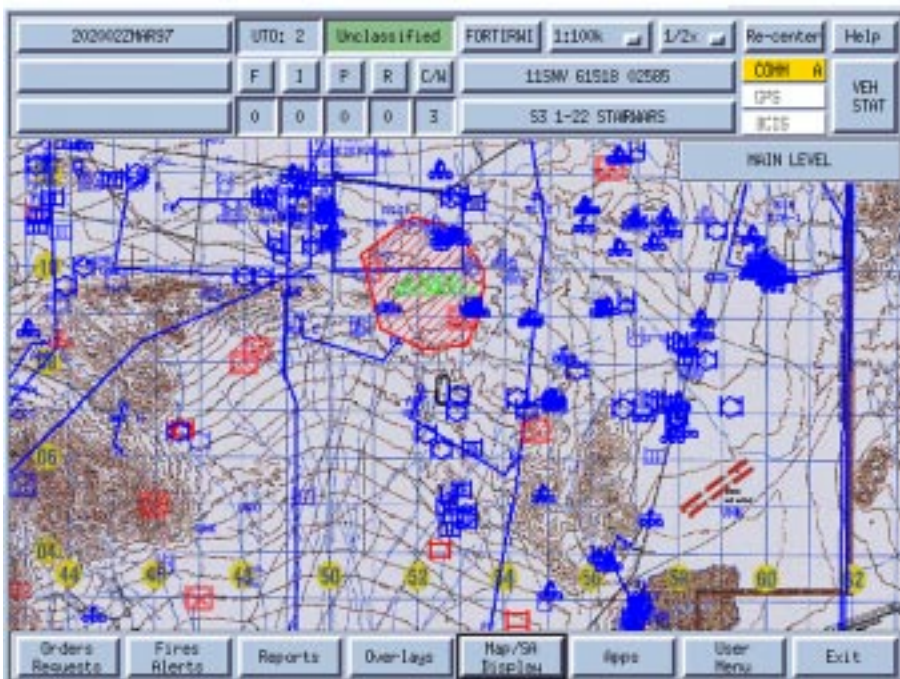
Figure 11. The FBCB2 screen for Task Force XXI advanced warfighting experiment.

subscriber equipment/tactical packet network, EPLRS and SINCGARS. This system requires manually relaying information. Boutelle said Force XXI communications will evolve to one internet: SINCGARS upgraded with "data capabilities"; EPLRS with "increased throughput"; and MSE with asynchronous-transfer mode capability. The Force XXI architecture will be more robust, flexible and automatic, Boutelle said.

Task Force XXI's FBCB2 Applique screen had user-friendly icons – important since typical communications on the Task Force XXI tactical Internet were more than 1 million situation-awareness messages a day and 3,000 to 4,000 C2 messages daily. Boutelle said soldiers could click on an icon and receive information such as name, platform/unit type, location, time, altitude and speed. The program also had a search capability. An icon's brightness told soldiers how current the information was. Other program features included the

ability to aggregate or deaggregate by echelon, plus screens could represent individual platforms, units, contaminated areas, obstacles or control measures.

FBCB2 enables a soldier to build and send a key report in 10 seconds; keeps its own "platform" in the map display's center; and provides battlespace awareness beyond the map's edge.

FBCB2's next generation will feature new display hardware with true sunlight readability of 1,800 nits; 160-degree viewing angle (readable from the side); higher-resolution screen (800x600 pixels); "a bigger screen in a smaller box"; tilt-swivel mount on most platforms; and "keyboard-less" entry via touch-screen (operational) or eight bezel buttons (close combat) for Abrams and Bradley tanks.

Remarking on the first digitized division's fielding in September 2000, Boutelle said, "This isn't a technical challenge, it's a management challenge."
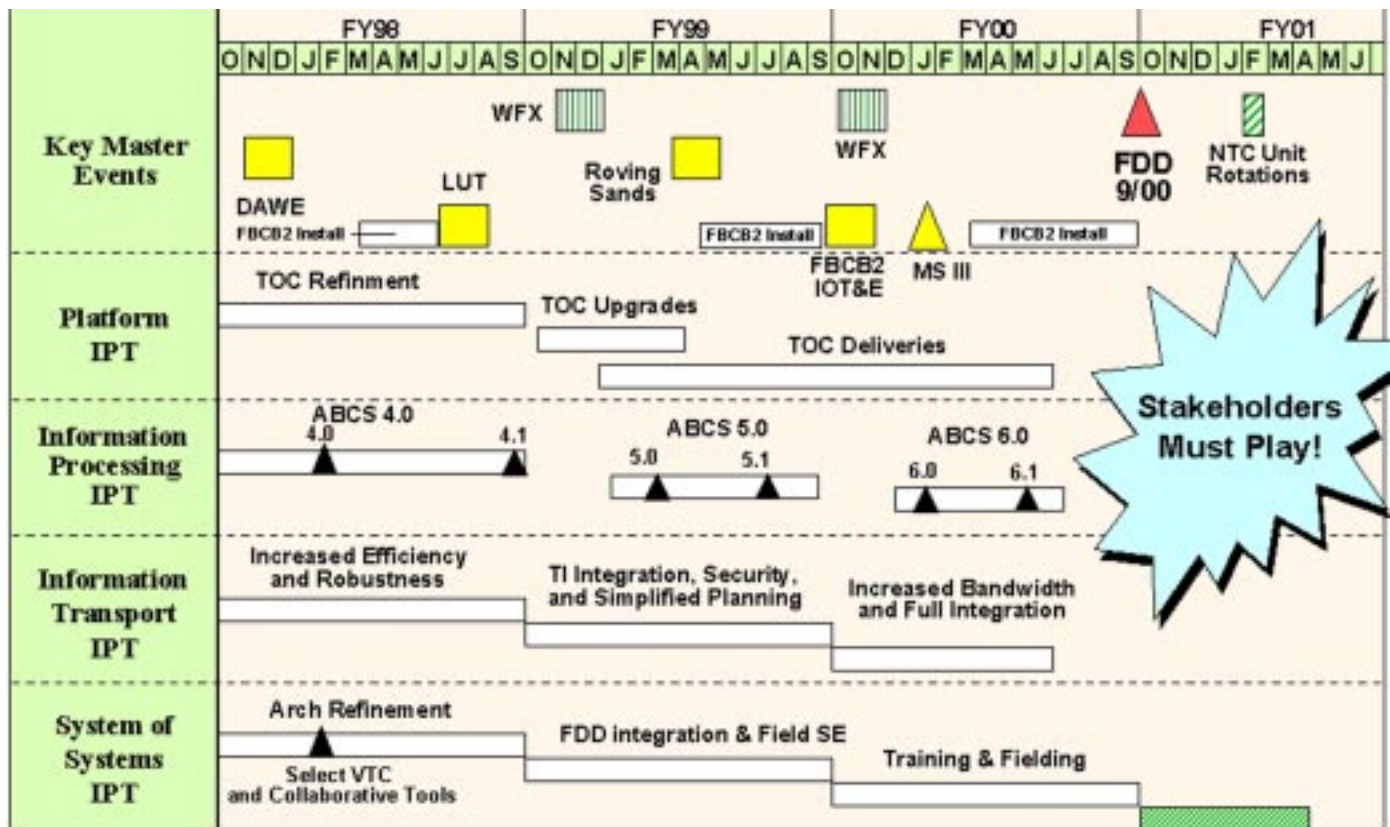
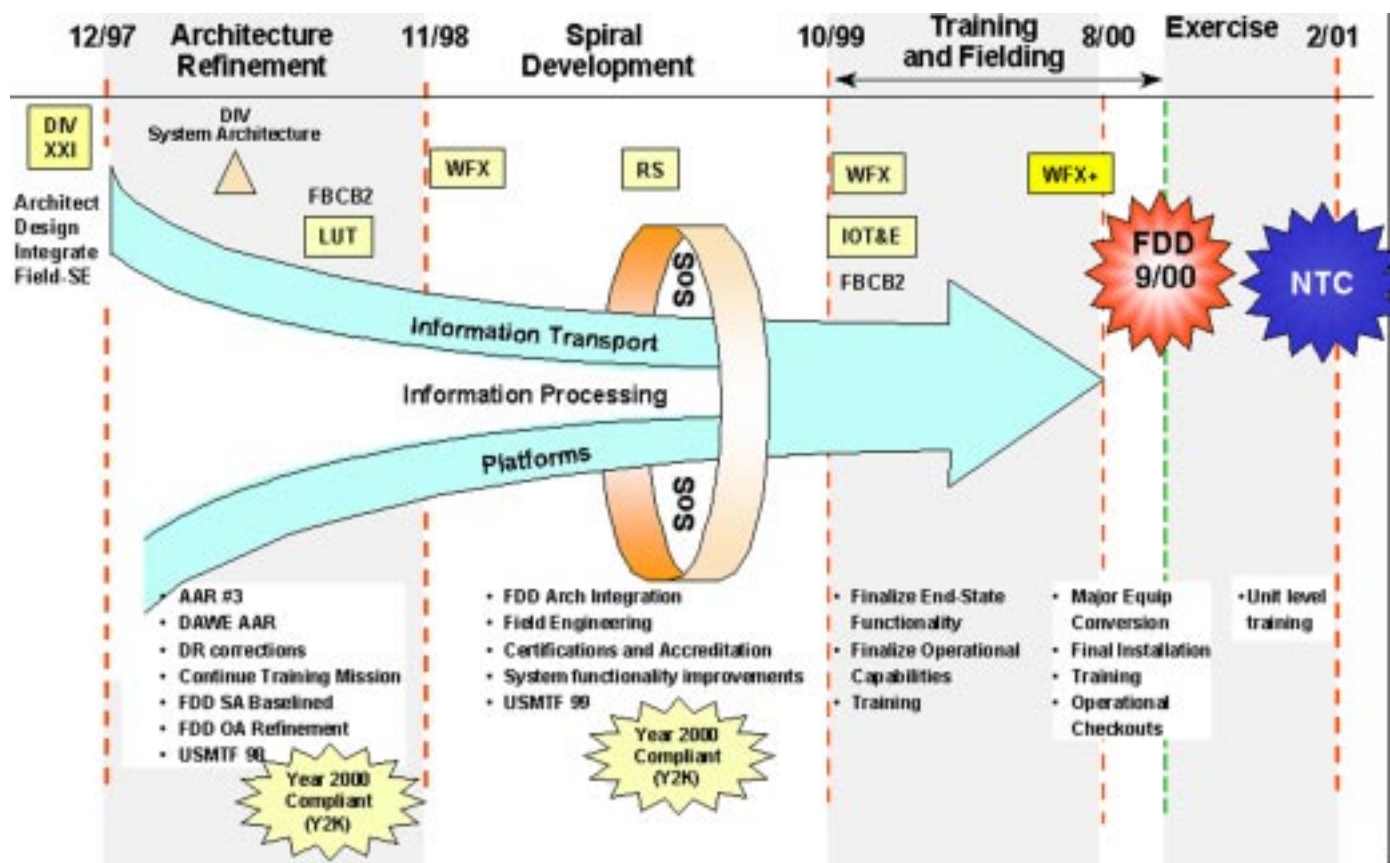**Figure 12. First digitized division master schedule.**

Figure 13. First digitized division campaign strategy.